

CLAIMS

1. A gas distribution unit for use in a rack that holds rack-mounted equipment that produces heat during operation, the gas distribution unit comprising:
 - 5 a housing defining a cavity, an exhaust port in a top wall of the housing, and at least one intake port configured to provide fluid communication between the cavity and a volume of gas external to the housing, the at least one intake port being at least partially laterally displaced relative to the exhaust port, the housing being configured to be disposed in and coupled to the rack and to direct gas from the cavity substantially directly
 - 10 upward through the exhaust port when coupled to the rack; and
 - at least one fan coupled to and disposed within the housing and configured to draw gas through the at least one intake port, and to force the drawn-in gas out of the gas distribution unit through the exhaust port.
- 15 2. The gas distribution unit of claim 1 wherein the exhaust port is defined adjacent a front edge of the housing.
3. The gas distribution unit of claim 2 wherein the housing has a curved transition between a bottom wall and a front side wall.
- 20 4. The gas distribution unit of claim 1 further comprising a plenum boot connected to the housing enclosing the at least one intake hole.

5. The gas distribution unit of claim 4 wherein the boot comprises a flexible material.
- 5 6. The gas distribution unit of claim 4 wherein an end of the boot that is displaced from the housing is configured to be attached to a surface defining a cool-gas port that provides access to a source of cool gas, the displaced end of the boot being configured to surround a perimeter of the cool-gas port.
- 10 7. The gas distribution unit of claim 1 wherein the housing is configured to be mounted into the rack such that a front wall of the housing is disposed adjacent to a front wall of the rack.
8. The gas distribution unit of claim 1 wherein the housing includes an interior wall that divides the cavity into a plurality of sub-cavities, and wherein the at least one fan includes at least one fan disposed within each sub-cavity.
- 15 9. The gas distribution unit of claim 8 further comprising multiple power inputs and a fail-over module electrically coupling the power inputs to the fans, the fail-over module being configured to disconnect a first of the power inputs from a first fan and connect a second of the power inputs to the first fan in response to a loss of power on the first power input.
- 20

10. The gas distribution unit of claim 8 wherein the at least one intake port includes at least one intake port for each sub-cavity, each intake port being associated with a corresponding fan, and wherein the fans each include a ring of fan blades
5 configured and disposed to surround a perimeter of the corresponding intake port, each fan being configured to rotate the ring to draw gas through the corresponding intake port into an interior of the fan and to force the drawn-in gas radially outward through the ring.

11. The gas distribution unit of claim 1 further comprising a filter apparatus
10 coupled to the housing and configured to filter gas drawn into the at least one intake port by the at least one fan.

12. A modular gas distribution unit for use in a rack that holds rack-mounted equipment that produce heat during operation, the rack-mounted equipment having
15 corresponding fronts, the gas distribution unit comprising in combination:

a housing;

a fan connected to the housing and configured to draw gas from a first region external to the housing and force the gas from the first region into a second region internal to the housing;

20 means for directing the gas forced into the second region upward adjacent the fronts of the rack-mounted equipment; and

means for guiding cool gas from a source of the cool gas to the first region, the means for guiding being configured to guide the cool gas for adjustable distances to accommodate different separations between the means for directing and the source of cool gas.

5

13. The gas distribution unit of claim 12 wherein the means for guiding includes a plenum comprising a flexible material.

14. The gas distribution unit of claim 12 wherein the means for directing
10 includes an interior wall of the housing dividing a cavity, defined by the housing, into sub-cavities, the gas distribution unit further including at least another fan, with at least one fan disposed in each sub-cavity.

15. The gas distribution unit of claim 14 further comprising a redundant
15 power distribution system coupled to provide power to the fans from multiple power sources, and to switch which power source provides power to a particular fan if the power source coupled to the particular fan fails.

16. The gas distribution unit of claim 14 further comprising a fan selector
20 configured to control at least one of which combination of the fans will receive power and at which speed at least one of the fans will operate.

17. The gas distribution unit of claim 12 further comprising a filter apparatus coupled to the housing and configured and disposed to filter the cool gas.

18. A method of cooling equipment modules disposed in a rack of equipment modules, the modules being disposed above one another in the rack, the modules including fans to draw gas from fronts of the modules through the modules and to expel the gas from backs of the modules, the modules having corresponding fronts, the method comprising:

drawing gas from a bottom region near a bottom of the rack;
10 guiding the gas from the bottom region to a lower front region disposed below the fronts of the modules; and

forcing the gas upward from the lower front region into an upper front region adjacent the fronts of the modules while inhibiting the gas from being initially forced into portions of the rack other than the upper front region.

15

19. The method of claim 18 wherein the inhibiting comprises forcing the gas from the lower front region into the upper front region through an exhaust port configured to guide the gas into the upper front region.

20. The method of claim 18 wherein the guiding comprises inhibiting gas flow using a flexible plenum coupled to a surface defining an opening that provides access to cool gas, the drawing and forcing comprising drawing and forcing the cool gas.

21. The method of claim 18 further comprising filtering the gas drawn from the bottom region.